

10/506646
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Patent Claims:

1. Proton-conducting polymer membrane based on polyvinylphosphonic acid obtainable by a process comprising the steps

5 A) Mixing a polymer with vinyl-containing phosphonic acid,

B) Forming a two-dimensional structure using the mixture according to step A) on a carrier,

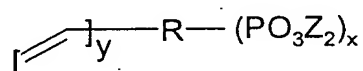
C) Polymerisation of the vinyl-containing phosphonic acid present in the two-dimensional structure according to step B),

10 characterised in that the membrane has a thickness in the range from 15 μm bis 1000 μm .

2. Membrane according to claim 1, characterised in that the polymer used in step A) are high temperature-stable polymers that contain at least one nitrogen, oxygen
 15 and/or sulfur atom in a repeating unit or in different repeating units.

3. Membrane according to claim 1, characterised in that one or more polyazoles and/or polysulfones are used in step A).

20 4. Membrane according to claim 1, characterised in that the mixture produced in step A) contains compounds of the formula



wherein

25 R denotes a bond, a C1-C15 alkyl group, C1-C15 alkoxy group, ethyleneoxy group or C5-C20 aryl or heteroaryl group, wherein the above radicals may in turn be substituted by halogen, -OH, -COOZ, -CN, NZ₂,

Z independently of one another denote hydrogen, a C1-C15 alkyl group, C1-C15 alkoxy group, ethyleneoxy group or C5-C20 aryl or heteroaryl group, wherein the aforementioned radicals may in turn be substituted by halogen, -OH, -CN,
 30 and

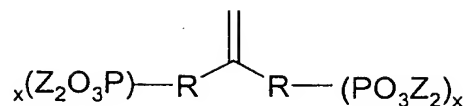
x is a whole number 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10

y is a whole number 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10

and/or the formula

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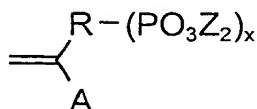
wherein

R denotes a bond, a C1-C15 alkyl group, C1-C15 alkoxy group, ethyleneoxy group or C5-C20 aryl or heteroaryl group, wherein the above radicals may in turn be substituted by halogen, -OH, -COOZ, -CN, NZ₂,

Z independently of one another denote hydrogen, a C1-C15 alkyl group, C1-C15 alkoxy group, ethyleneoxy group or C5-C20 aryl or heteroaryl group, wherein the aforementioned radicals may in turn be substituted by halogen, -OH, -CN, and

x is a whole number 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10

and/or the formula



wherein

A represents a group of the formulae COOR², CN, CONR²₂, OR² and/or R², wherein R² denotes hydrogen, a C1-C15 alkyl group, C1-C15 alkoxy group, ethyleneoxy group or C5-C20 aryl or heteroaryl group, wherein the aforementioned radicals may in turn be substituted by halogen, -OH, COOZ, -CN and NZ₂

R denotes a bond, a double bond C1-C15 alkylene group, C1-C15 alkyleneoxy group, for example an ethyleneoxy group or double bond C5-C20 aryl or heteroaryl group, wherein the above radicals may in turn be substituted by halogen, -OH, -COOZ, -CN, NZ₂,

Z independently of one another denote hydrogen, a C1-C15 alkyl group, C1-C15 alkoxy group, ethyleneoxy group or C5-C20 aryl or heteroaryl group, wherein the aforementioned radicals may in turn be substituted by halogen, -OH, -CN, and

x is a whole number 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10.

5. Membrane according to claim 1, characterised in that the mixture prepared in step A) contains monomers capable of undergoing crosslinking.

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6. Membrane according to claim 1, characterised in that the polymerisation according to step C) is effected by a substance that is capable of forming free radicals.

7. Membrane according to claim 1, characterised in that the polymerisation according to step C) is carried out by irradiation with IR or NIR light, UV light, β , γ rays and/or electron beams.

8. Membrane according to claim 1, characterised in that the membrane has an intrinsic conductivity of at least 0.001 S/cm.

9. Membrane according to claim 1, characterised in that the membrane contains between 0.5 and 97 wt.% of the polymer and between 99.5 and 3 wt.% of polyvinylphosphonic acid.

10. Membrane according to claim 1, characterised in that the membrane comprises a layer containing a catalytically active component.

11. Mixture containing vinyl-containing phosphonic acid defined in claim 4 and at least one polymer that has a solubility of at least 1 wt.% at a temperature of 160°C and 1 bar in the vinyl-containing phosphonic acid, characterised in that the polymer is selected from polyazoles and/or polysulfones..

12. Mixture according to claim 11, characterised in that the mixture contains at least one monomer capable of undergoing crosslinking.

13. Mixture according to claim 11, characterised in that the mixture contains at least one starter that is capable of forming free radicals.

14. Membrane-electrode unit containing at least one membrane according to one or more of claims 1 to 10.

15. Fuel cell containing one or more membrane-electrode units according to claim 14 and/or one or more membranes according to one of claims 1 to 10.

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